PATENT SPECIFICATION 1,027,369

DRAWINGS ATTACHED.

1,027,369

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COMPLETE SPECIFICATION.

Improvements in or relating to Powder Feeding Devices for Powder-Fed Flame Spraying Torches.

We, EUTECTIC WELDING ALLOYS CORPORATION, a corporation organized and existing under the laws of the State of New York, United States of America, of 40-40 172nd Street, Flushing 59, State of New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a powder feeding device for a powder-fed flame spraying torch, and it more particularly relates to powder container aspects of such a device.

Powder containers for flame spraying torches which inject powder into the emitted stream of burning gas to fuse them upon a surface generally include an air opening into the container to prevent an internal reduction of pressure which might interfere with dispensing of the powder. Such apertures are usually disposed in the end of the container remote from its coupling to the torch, which end constitutes the bottom of the container when it is removed from the torch for storage. These holes must therefore be sealed when the containers are removed from the torch to prevent spillage. They are also likely to spill powder when the torch is being used in a position that disposes the container in substantially horizontal and below horizontal dispositions. However powder-fed flame spraying torches with air inlet apertures into their powder containers usually cannot be used in positions that cause the powder to flow away from their outlets.

An object of this invention is to provide a simple and economical powder feeding device for mounting upon a powder-fed flame spraying torch that dependably feeds powder without the necessity for any pressure equalizing air inlet opening into the powder container.

Another object is to provide such a device which helps to make the dispensing of powder more independent of container position.

In accordance with this invention the walls of the powder container mounted on a powder-fed flame spraying torch and the means that couple it thereto are substantially sealed to isolate the contents of the container from the atmosphere. A wall of the container is movably constructed to cause it to move inwardly when the internal pressure within the container is reduced by the dispensing of powder. Such movement minimizes the reduction of internal pressure to facilitate the exhaustion and dispensing of substantially all of the powder content into the powder supplying channel of torch neck container without requiring a pressure equalizing aperture. Such a movable wall may be elastic, resilient or collapsible with or without movement-accommodating bellows formations, or it might be a sliding outer wall. It might also be an elastic or resilient diaphragm within the container that separates it into sealed and powder containing chambers.

Bellows may be confined to the end of the container remote from the coupling to maintain the portion adjacent the coupling smooth for facilitating the feeding of powder through it, and they may also be disposed upon the entire length of the wall for facilitating the substantially complete collapse of the container upon reduction of internal pressure, thereby promoting the substantially complete dispensing of the entire powder content regardless of container position. The end of such a container remote from the coupling may also be made in a form that

[*Price 4s. 6d.*]

facilitates its concave deformation to help force any remaining powder into the torch neck upon the substantially complete collapse of the container whereby the confinement of said powder within said neck regardless of container position is promoted.

A sealed container with a movable outer wall that does not completely accommodate changes in internal pressure can be adapted for feeding from inverted portions by extending a tube from the powder supplying channel within the container adjacent the end remote from the outlet. Such a container is so independent of position that it can feed powder even when completely inverted.

The invention will now be described by way of example with reference to the accompanying drawings wherein similar reference characters refer to similar parts and in which:

Figure 1 is a view in elevation of one embodiment of this invention partly broken away in cross-section;

Figure 2 is a top-plan view of the powder container relative to the disposition shown in Figure 1;

Figure 3 is a view in elevation of the powder container shown in Figures 1 and 2 removed from the torch;

Figure 4 is an end view of the adjacent portion of the container shown in Figure 3;

Figure 5 is a top-plan view of the means for connecting a container of the torch shown in Figure 1;

Figure 6 is a cross-sectional view taken through Figure 5 along the line 6—6;

Figure 7 is a view in elevation of a portion of the embodiment shown in Figure 1 when the internal pressure of the powder container is reduced;

Figure 8 is an inside-plan view of a cap for the container shown in Figures 2 to 4;

Figure 9 is a cross-sectional view taken through Figure 8 along the line 9—9;

Figure 10 is a view in elevation of a powder container that constitutes another embodiment of this invention in conjunction with the torch;

Figure 11 is a cross-sectional view taken through a powder-fed flame spraying torch upon which the container shown in Figure 10 is mounted in the form that it assumes upon a reduction in internal pressure within the powder container as a result of discharge of the contents;

Figure 12 is a cross-sectional view in elevation of still another embodiment of this invention in conjunction with the torch;

Figures 13 and 14 are cross-sectional views in elevation of a further embodiment of this invention in different phases of operation;

Figure 15 is a cross-sectional view in elevation of still a further embodiment of this invention;

Figure 16 is a view in elevation of a still further collapsible embodiment of this invention;

Figure 17 is a cross-sectional view in elevation taken through the embodiment shown in Figure 16; and

Figure 18 is a view in elevation of the internal collapsible portion of the embodiment shown in Figures 16 and 17.

In Figure 1 is shown a powder feeding device 10 mounted upon a powder-fed flame spraying torch 12 which injects powder 14 from a container 16 into the stream 18 of burning gas emitted from the torch 12. The powder 14 is injected into the gas stream 18 by dispensing it from the container 16 coupled to a connecting portion 20 of the torch 12 in communication with a powder supplying channel 22 that intersects a longitudinal gas conducting passageway 24 in the torch 12. The flow of powder through the channel 22 is controlled by a valve (not shown) actuated by a lever 26.

As shown in Figures 1 to 6, the container 16 is coupled to the connector 20 by coupling means in the form of a coupling generally indicated at 28 in Figure 1. The coupling 28 includes bayonet lugs 30 shown in Figures 3 and 4 on the neck 32 of the container 16 engaged within a slotted bayonet ring 34 disposed within the connector 20 as shown in Figures 5 and 6. The coupling 28 provides a substantially air-tight seal. The connector 20 is secured upon the torch 12 by screw threads 35 that engage within corresponding internal screw threads 36^1 within the body of the torch 12.

The container 16 is made of an elastic and resilient material such as polyethylene, and it is constructed to deform inwardly upon reduction of internal pressure as shown in Figure 7. This condition occurs when powder 14 is withdrawn from the container 16 thereby reducing the internal pressure below atmospheric pressure. The upper portion of the side wall 40 of the container 16 is made in the form of bellows 36 for facilitating the inward deformation or collapse of the container 16 as illustrated in Figure 7 and the subsequent outward movement of the walls 40 and the rear end 38 when pressure is equalized. The bellows 36 are confined to the portion of the container remote from the coupling 28, and the portion of the wall 40 adjacent the coupling 28 is maintained smooth to facilitate dispensing of the powder.

As shown in Figure 7, the bellows 36 are compressed tightly upon each other, and the top end 38 and side wall 40 of the container 16 are also slightly inwardly deformed because of the exhaustion of powder therefrom caused by its entrainment into the gas pas-

sageway 24 through the powder supplying channel 22. The inward deformation of the walls helps prevent a reduction of pressure in the container 16 to such an extent that it permits the feeding of powder 14 into the gas stream before practically all of it is used. The need for any pressure equalizing aperture into the container 16 is thereby eliminated. However a slight air passage through the coupling 28 will ensure that all the powder 14 can be dispensed freely. Such a slight passage is disclosed and claimed in our copending British Patent Application, No. 50237/63, Serial No. 1,027,370.

Figure 7 shows the condition that exists when practically all the powder 14 is dispensed from the container 16 during one feeding operation. However, usually not all of the powder content is dispensed during one operation, and the pressure within the container is readily therefore restored before all of it is exhausted. This permits all the powder 14 within the container 16 to be dispensed during a subsequent operation. This recharging of the pressure within the container can be accomplished through the heated tip 41 of the torch 12, by tripping the valve control lever 26 when the gas supply is shut off, thereby minimizing the moisture content in the recharging air. This maintains the contents of the container 16 dry and prevents caking of the powder which would prevent its smooth and even dispensing. This powder feeding device therefore provides a controlled atmosphere for storage of the powder that is not possible where an atmospheric pressure equalizing aperture is provided upon the container. A protective atmosphere such as nitrogen gas can be maintained within the container 16 even after repeated use, which might somewhat dilute it with air during the aforementioned recharging but not completely neutralize it.

The appreciable inward deformation or collapse of the container 16 also facilitates the confinement of the powder to the neck or outlet 32 of the container to such an extent that the torch 12 can be inclined in dispositions in which the longitudinal axis of the powder container 16 is substantially horizontally disposed. The lack of need for an equalizing aperture also avoids spillage of powder in such dispositions away from the vertical of the axis of the container 16. It is also believed that the rate of powder feed is increased by the substantially sealed container of this invention over containers fully open to atmosphere because it minimizes air dilution to permit more powder to be fed per unit time.

In Figures 8 and 9 there is shown a cap 42 for sealing the neck 32 of the container 16 when, as shown in Figure 3, it is removed from the torch 12. The cap 42 includes a slotted bayonet aperture 44 for engaging the bayonet lugs 30 on the neck 32 of the container 16. A tapered plug 46 within the cap 42 closely engages within the neck 32 to seal the contents of the container 16 from the atmosphere.

In Figures 10 and 11 there is shown another embodiment 10A having a modified container 16A that incorporates bellows 36A along the entire length of the side wall 40A which is tapered inwardly toward the neck 32A, which neck includes bayonet lugs 30A. The rear end 38A remote from the neck 32A has a concave form. In Figure 11 the container 16A is shown in the form into which it collapses when it is mounted upon a torch 12A, which has dispensed most of its contents. The container 16A is capable of substantially complete collapse with the end 38A entering in between the collapsed bellows 36A to push the small remaining amount of powder 14A into intimate contact with the entrance to the powder supplying channel 22A, leading to gas passageway 24A. Powder is accordingly efficiently dispensed in a substantially uphill direction, which is completely impossible from the prior fully vented powder feeding device.

In Figure 12 there is shown another embodiment 10B of this powder-fed torch which is similar to that described in Figure 1 with the exception that a tube 50B is inserted within the throat 52B of the connector 20B to permit the device 10B to dispense powder to the torch 12B in the inverted position shown in Figure 12. A small recess 54B is disposed in the entrance to the throat 52B for receiving the end of the tube 50B, which is for example made of polyethylene. Such a tube of proper size can also be wedged securely into the curved entrance 54 to the throat 52 of the connector 20 shown in Figure 6.

As shown in Figure 12, the end 56B of the tube 50B remote from the connector 20B is adjusted to be spaced a short distance from the end 38B of the container 16B when it is in the fully compressed condition. The tube end 56B is accordingly disposed approximately $\frac{1}{8}$ inch from the container end wall 38B when it is disposed in a partially compressed condition. Because the container 16B is substantially completely sealed, powder 14B is entrained within the tube 50B and moved upwardly against the force of gravity into the powder supplying channel 22B and dispensed into the longitudinal gas conducting passageway 24B. A remarkably simple and effective device for feeding powder from an inverted container is therefore provided. This is quite remarkable in view of the previous sensitivity of prior powder-fed torches to gravity flow.

The coupling arrangement of Figure 12 is similar to that shown in Figure 1. For

example, connector 20B includes screw threads 35B for coupling to the torch, and bayonet ring 34B which engages lugs 30B of neck 32B.

In Figures 13 and 14 there is shown another embodiment 10C of this invention when used in conjunction with the torch, which is capable of dispensing powder from any inclination including inverted. The feeding device 10C incorporates a container 16C having an internal elastic wall 56C which is for example a diaphragm of an elastic material such as rubber or neoprene sealed to the walls 40C of the container 16C. The diaphragm 56C divides the container 16C into a pressure chamber 58C and a powder containing chamber 60C. Although the chamber 58C is referred to as a pressure chamber, it might only be subjected to atmospheric pressure trapped within it at the time of sealing the diaphragm 56C within the container 16C.

The device 10C operates to urge powder 14C into the neck 32C of the container 16C regardless of inclination because as shown in Figure 14 the diaphragm 56C expands toward the neck 32C as powder and pressure are withdrawn from the powder containing chamber 60C. The diaphragm 56C might be elastic enough to extend completely through the exit of the neck 32C when the powder contents 14C are exhausted to force the powder 14C into the powder supplying channel 22C (leading to passageway 24C) to maintain it closely packed with powder at all times. Complete dispensing of the powder 14C is accordingly assured regardless of container inclination. When the diaphragm 56C is resilient, it snaps back into its original position shown in Figure 13 when pressure is equalized. This can be accomplished through the heated tip of the torch to minimize the amount of water vapor drawn into the container 16C. A partially full container 16C can be exhausted to the condition shown in Figure 14 by inverting the torch 12C and operating it until all air is exhausted and powder starts to flow into the emitted gas stream. Connector 20C of Figs. 13—14 also includes screw threads 35C for coupling to the torch, and bayonet ring 34C which engages lugs 30C of neck 32C.

In Figure 15 is shown another powder feeding device 10D in which a movable wall 38D is a sliding end wall of the container 16D that is sealed within a cylindrical wall 40D by a sliding seal 60D incorporating an annular groove 62D. A retaining ring 64D upon the end of the wall 40D maintains the sliding wall 38D inserted within the container 16D when it is filled with powder 14D. The container 16D and the wall 38D may be made of a plastics material such as polyethylene to facilitate their sealed sliding assembly. As powder 14D is exhausted from the container 16D, atmospheric pressure reacting upon the outside of the wall 38D forces it toward the outlet neck 32D thereby maintaining the powder 14D in intimate contact with the powder supplying channel 22D (leading to passageway 24D) to promote the full exhaustion of all powder from the container 16D regardless of inclination. Since the wall 38D does not move backward when pressures on both of its sides equalize, no air is pulled into the container 16D upon equalization of pressure. This maintains its contents protected from atmospheric affects such as wetting and oxidation. The position of the wall 38D also indicates the amount of powder remaining in the container without the necessity for having the walls transparent, and such position in conjunction with suitable indicia 66D upon the walls 40D precisely indicates how much powder remains for dispensing. Connector 20D of Fig. 15 also includes screw threads 35D for coupling to the torch 12D, and bayonet ring 34D which engages lugs 30D of neck 32D.

In Figures 16 and 17 there is shown another powder feeding device 10E in which a movable wall 38E is provided by a collapsible plastic sac. The plastic sac 38E is part of the container 16E including a substantially rigid tube 68E engaged within an outlet funnel 70E. The tube 68E is made for example of a substantially rigid plastics material such as polystyrene or an acrylic resin, which might be transparent to permit the contents of the container 16E to be directly observed. The plastic sac 38E, as shown in Figure 18, is utilized as a storage container for powder 14E prior to usage. A clip 72E seals the top of the sac 38E prior to use.

The sac 38E is secured within the container 16E by locking its open edge 71E between a flange 74E upon the tube 68E and a corresponding lip 76E upon the outlet funnel 70E. The outlet funnel 70E is secured to the powder feeding section 12E by screw threads 78E upon its discharge end. The outlet funnel 70E is made of a resilient material such as rubber or neoprene to facilitate the snap fitting of the lower end 74E of the tube 68E into and out of engagement with the lip 76E. The inner annular surface of the funnel accordingly acts as a locking ring for the sac.

Figure 17 shows the condition of the container 16E after a substantial amount of powder 14E has been discharged into the gas stream admitted to the torch (not shown). The plastic sac 38E, for example made of inexpensive polyethylene, has substantially collapsed to help urge the powder within it into the discharge outlet 70E thereby helping to ensure that all the powder is discharged from the container and minimizing the influence of gravity. The arrangement

shown in Figures 16 to 18 is somewhat similar to a type of baby nursing kit, but it is rather surprising that a type of feeding device intended for a liquid will prevent an undue reduction of pressure within a powder feeding container. A metal powder is in no way comparable to a liquid such as milk, and there was no disclosure of suggestion prior to this invention that a collapsible feeding sac would prevent an undue reduction in pressure within an alloy powder feeding container of a flame spraying torch.

WHAT WE CLAIM IS:—

1. A powder-fed flame spraying torch having a powder-feeding device comprising a longitudinal gas conducting passageway through said torch, a means for connecting a container upon said torch, a powder supplying channel in said torch extending from within said means for connecting a container to intersection with said gas conducting passageway, a powder container, coupling means engaging said container with said means for connecting a container for supplying powder to said powder supplying channel, the walls of said container being substantially sealed to isolate the contents of said container from the atmosphere, and at least one of said walls being movably arranged to cause it to move inwardly upon reduction of internal pressure to facilitate the exhaustion and dispensing of said powder into said powder supplying channel.

2. A torch as claimed in claim 1, wherein a movably arranged wall is resiliently constructed to cause it to move outwardly back to its original shape when an atmospheric internal pressure is restored, whereby the dispersing of a small remainder of powder is facilitated.

3. A torch as claimed in claim 1 or claim 2, wherein the container includes a neck disposed remote from a movably arranged or said resiliently constructed wall, and part of the coupling means is disposed upon said neck.

4. A torch as claimed in claim 1, claim 2 or claim 3, wherein a portion of the wall is made in the form of bellows for facilitating the inward movement and subsequent outward movement.

5. A torch as claimed in any one of claims 1 to 4, wherein the portion of the container remote from the coupling means is made in the form of the bellows whilst the portion of said container adjacent said coupling means is maintained smooth to facilitate dispensing of the powder.

6. A torch as claimed in any preceding claim, wherein said movably arranged wall is made of a resilient plastic material.

7. A torch as claimed in claim 4 or claim 5, wherein the bellows is disposed upon the entire length of the container for facilitating the substantially complete collapsing of said container upon reduction of internal pressure whereby the substantially complete dispensing of the entire powder content of said container regardless of container position is facilitated.

8. A torch as claimed in any preceding claim wherein the end of the container remote from the torch is concavely shaped.

9. A torch as claimed in claim 4, claim 5 or claim 7, wherein the bellowed walls of the container are inwardly tapered for funnelling powder.

10. A torch as claimed in any preceding claim wherein a tube extends from the means for connecting a container in sealed communication with the powder supplying channel into the container, the end of said tube remote from said means for connecting a container extending adjacent to a wall of said container remote from said means connecting a container for conducting powder therefrom into said powder supplying channel whereby said powder feeding device dispenses said powder independently of gravity.

11. A torch as claimed in claim 1, wherein a movably arranged wall comprises a sliding wall, and a sliding seal connects said wall to the remainder of the container whereby said sliding wall maintains the powder in said container urged towards the powder supplying channel in response to the force of atmospheric pressure acting upon the outside of said wall which causes it to move out as pressure within said container is reduced as powder is dispensed.

12. A torch as claimed in claim 1, wherein a movably arranged wall comprises a flexible diaphragm that divides the container into a sealed chamber and a powder containing section whereby powder is maintained urged out of the powder containing section the pressure in said sealed chamber reacting against said diaphragm when pressure is reduced in said powder containing section regardless of the position of said container.

13. A torch as claimed in claim 1, wherein a movable wall is made of a flexible sheet material which collapses inwardly upon reduction of internal pressure.

14. A torch as claimed in claim 13, wherein the movable wall is part of a sac made of relatively thin flexible plastics material.

15. A torch as claimed in claim 14, wherein a substantially rigid tube is incorporated in the container, the plastic sac being inserted within said tube for protecting it and guiding its contents into the powder supplying channel.

16. A torch as claimed in claim 15, wherein the container also includes an out-

let funnel made of resilient material, and a locking ring engaging the plastic sac of the container between the funnel and the tube.

17. A powder-fed flame spraying torch having a powder feeding device substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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Chartered Patent Agents.

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Sheet 1

Fig.1.

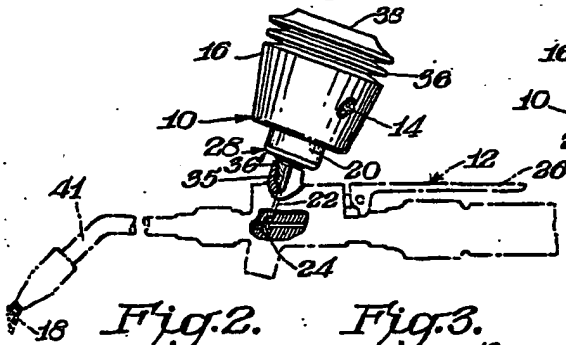


Fig.7.

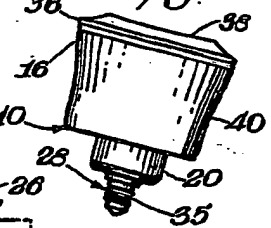


Fig.2.

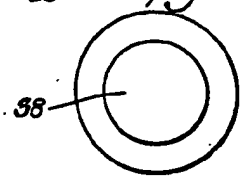
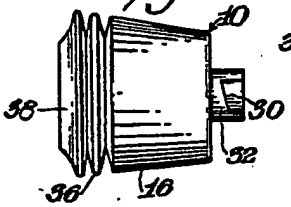


Fig.3.



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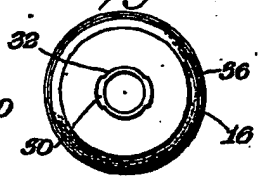


Fig.5.

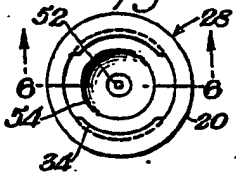


Fig.10.

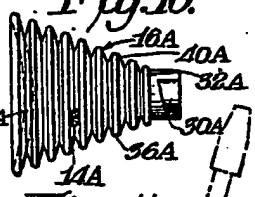


Fig.8.

Fig.9.

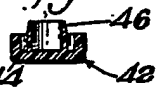


Fig.6.

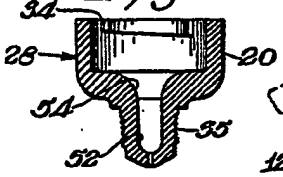


Fig.11.

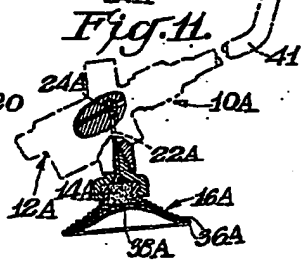


Fig.12.

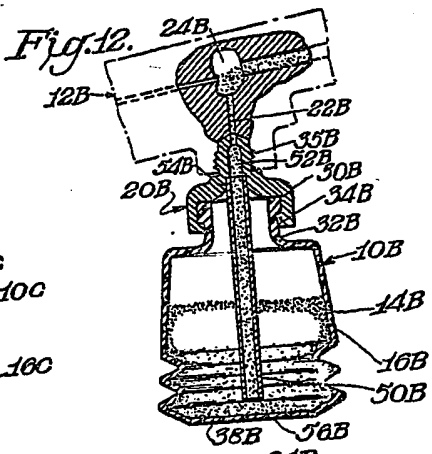


Fig.13.

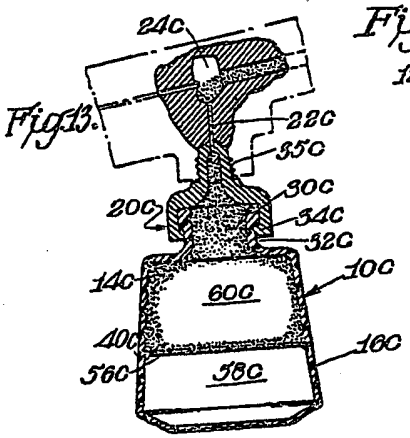


Fig.14.

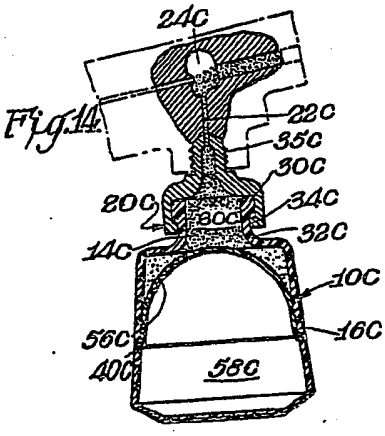
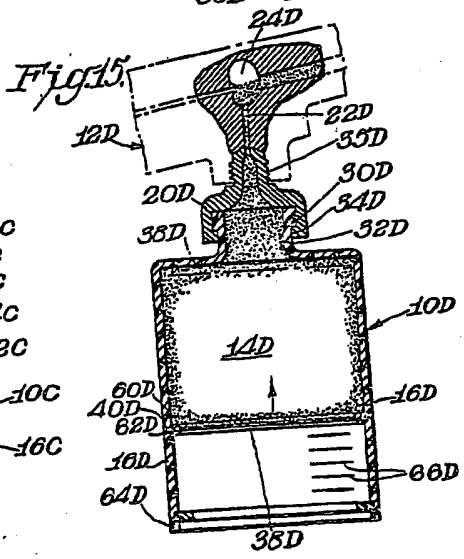


Fig.15.



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Sheets 2 & 3

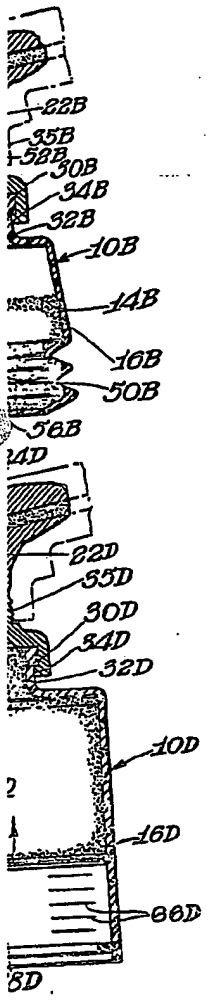


Fig. 10.

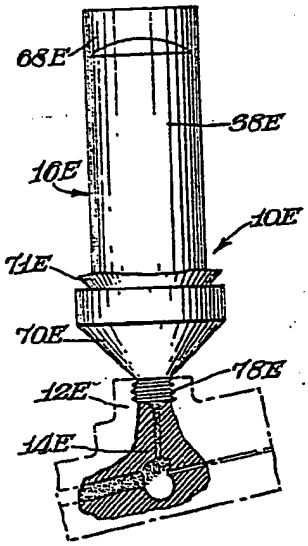


Fig. 17.

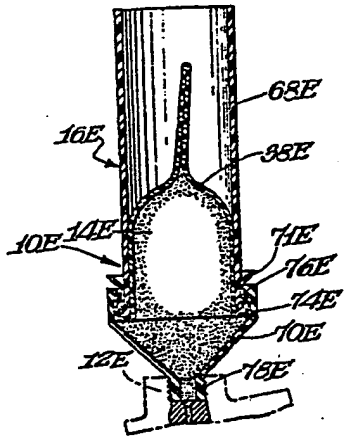
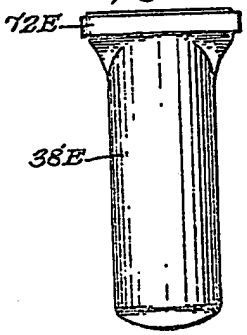


Fig. 18.



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Sheets 2 & 3

Fig.13.

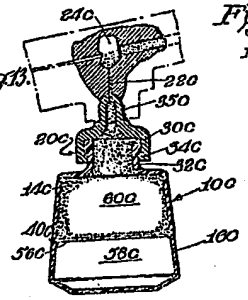

Fig.12.

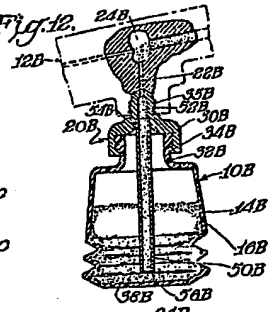

Fig.14.

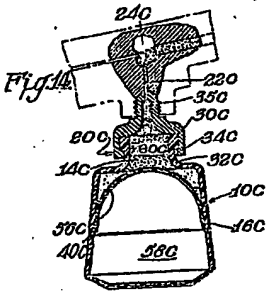

Fig.15.

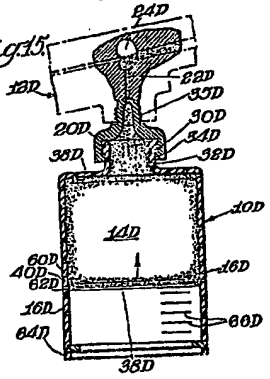

Fig. 10.

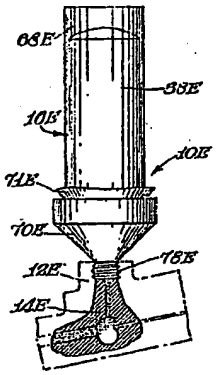

Fig. 18.

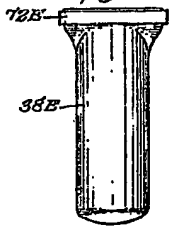

Fig. 17.